
Five New Species of *Solanum* Section *Geminata* (Solanaceae) from Peru and Ecuador

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ABSTRACT. Five new species of *Solanum* sect. *Geminata* are described from Peru and Ecuador: *S. clivorum*, *S. goniocaulon*, *S. malletii*, *S. smithii*, and *S. tovarii*. Relationships within section *Geminata* are discussed, and an illustration and distribution map are provided for each species.

Solanum is one of the largest genera of flowering plants, with some 1,500–2,000 valid species. Most of these species are neotropical, with taxa occurring in all habitats throughout the tropics and subtropics. Peru and Ecuador are particularly rich in *Solanum* species, probably due to their great diversity in habitat (Weberbauer, 1945). Section *Geminata* is one of the largest of the subdivisions of the nonspiny solanums, with about 145 species, all but one of these neotropical. Species of section *Geminata* are distinguished by their small white flowers, woody habit, usually leaf-opposed inflorescences, and hard green fruits at maturity (in all except the *S. pseudocapsicum* alliance).

Solanum clivorum S. Knapp, sp. nov. TYPE: Peru. La Libertad: entre Huamachuco y Cajabamba, 3,000–3,200 m, 16 Mar. 1948, *Ferreira* 3059 (holotype, USM; isotypes, IBE, MO, US). Figure 1.

Frutex; caules dense pubescentes; sympodia difoliata geminata vel plurifoliata; folia elliptica supra glabra subtus dense dendritico-pubescentia; inflorescentiae foliis oppositae vel terminales dendriticae; corolla alba; bacca globosa in pedicello deflexo inserta; semina complanata reniformia.

Bushy shrubs, 2–3 m tall; young stems and leaves densely pubescent with dendritic trichomes ca. 0.5 mm long; bark of older stems reddish or green, glabrous. *Sympodial units* difoliate, geminate, or appearing plurifoliate due to rapid inflorescence growth. *Leaves* elliptic, commonly with several axillary shoots, glabrous (occasionally with scattered simple uniseriate trichomes on the lamina) and with a few dendritic trichomes along the main veins adaxially, densely pubescent with dendritic trichomes abaxially; major leaves 13–21 cm long, 6–9 cm wide, with 7–9 pairs of primary veins, these drying

yellowish, the apex acute, the base acute; petiole 2–3 cm long; minor leaves differing from the majors only in size, 7–10 cm long, 3–4 cm wide, the apex acute, the base acute; petiole 1–2 cm long. *Inflorescences* opposite the leaves or appearing shoot-terminal, 3–7 cm long, many-times branched, 20–40-flowered, densely pubescent with dendritic trichomes; pedicel scars unevenly spaced 1–2 mm apart. *Buds* globose, the corolla only halfway exerted from the calyx tube. *Pedicels at anthesis* erect, tapering, 6–8 mm long, ca. 0.5 mm diam. at the base, densely pubescent with soft dendritic trichomes like those of the rest of the inflorescence. *Flowers* with the calyx tube conical, 1–1.5 mm long, the lobes deltate, 0.5–1 mm long, densely pubescent with dendritic trichomes; corolla white, 1–1.1 cm diam., lobed halfway to the base, the lobes planar at anthesis, densely pubescent on abaxial lobe surface with minute, dendritic trichomes; anthers 1.5–2 mm long, 1–1.5 mm wide, poricidal at the tips, the pores not opening to slits; free portion of the filaments ca. 0.5 mm long, the filament tube ca. 0.5 mm long, with 5 triangular projections ca. 0.5 mm long alternating with the anthers and closely investing the style; ovary glabrous; style 3–4 mm long, glabrous; stigma capitate, the surface minutely papillose. *Fruit* a globose, green berry, 1–1.2 cm diam.; fruiting pedicels woody, erect, 1.5–1.7 cm long, ca. 1.5 mm diam. at the base. *Seeds* dark reddish brown, flattened-reniform with thickened margins, 3–4 mm long, 2–2.5 mm wide, the surfaces minutely pitted.

Distribution. In the Cajabamba valley, department of Cajamarca, Peru, on steep rocky slopes from 2,000 to 2,800 m. Figure 5.

Paratypes. PERU. CAJAMARCA: Cutervo, Laguñac, camino a Cochabamba, 2,000 m, 26 Feb. 1985, *Llatas Quiroz* 1178 (F); Cajabamba, Finca Zúl, 2,500 m, 22 Aug. 1985, *Mostacero L. & Guerra L.* 63 (HUT, MO, NY); Cajamarca, entre Matara y Namora, 2,600 m, 16 Aug. 1973, *Sánchez Vega et al.* 1217 (NY); Namora–Matara, 2,600 m, 16 Aug. 1973, *Sagástegui A.* 7755 (HUT, MO, NY); Huamachuco–Cajabamba, 2,800 m, 16 Nov. 1983, *Sagástegui A.* 11144 (HUT, NY).



Figure 1. *Solanum clivorum* S. Knapp (from *Ferreyra* 3059, USM). Scale bar = 1 cm.

Local name. Cajamarca: shirac.

Solanum clivorum is closely related to the common and widely distributed species *S. oblongifolium* Dunal. It differs from *S. oblongifolium* in its smaller flowers, denser pubescence, and in the projections

from the filament tube. *Solanum clivorum* is unusual in section *Geminata* in not having the terminal pores of the anthers elongate to slits with age or drying. This condition is also found in *S. reitzii* and *S. pseudoquina*, two species not closely related to *S.*

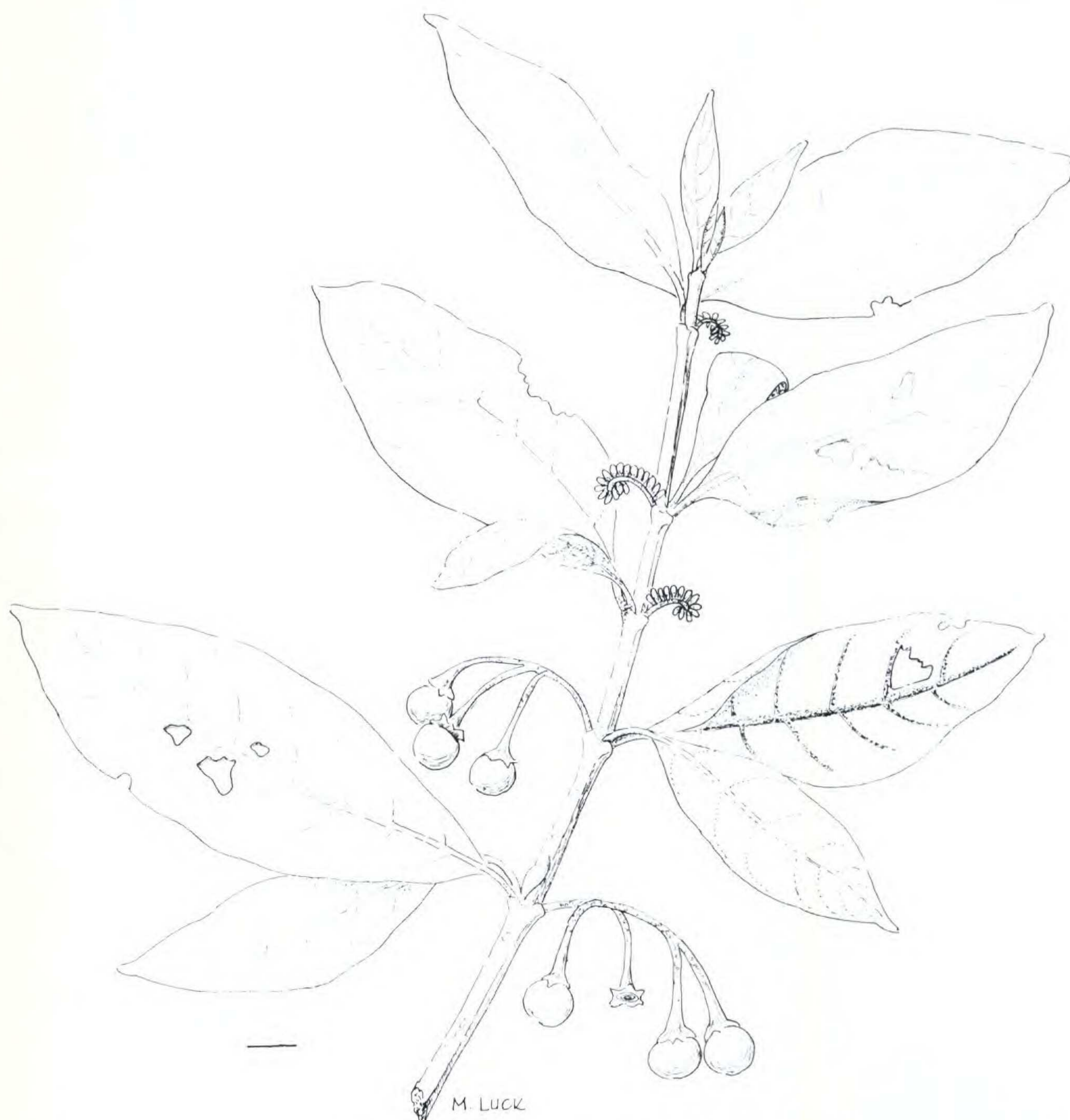


Figure 2. *Solanum goniocaulon* S. Knapp (from Young 4213, NY). Scale bar = 1 cm.

clivorum and found in southern Brazil. The restricted range of *S. clivorum* is within the range of *S. oblongifolium*, but *S. clivorum* appears to occur in drier microhabitats.

This species is named for its habitat (*clivorum*—growing on slopes).

***Solanum goniocaulon* S. Knapp, sp. nov. TYPE:**

Peru. San Martín: Río Abiseo National Park, hill E of Gran Pajaten ruins, 2,350 m, ca. 7°S, 77°W, 13 Aug. 1986, K. Young 4213 (holotype, HUT; isotypes, K, NY). Figure 2.

Frutex vel arbor; caules glabri valde quadrangulati; sympodia difoliata geminata; folia elliptica supra glabra nitida subtus glabra nitida in status sicco aurea; corolla ignota; bacca globosa glabra in pedicello deflexo inserta; semina ovoideo-reniformia.

Trees, 7 m tall; young stems and leaves minutely pubescent with golden uniseriate trichomes ca. 0.5 mm long; stems distinctly four-angled, erect; bark of older stems yellow-gray, glabrate. *Sympodial units* difoliolate, geminate. *Leaves* elliptic, thick and leathery, glabrous and shiny adaxially, drying dark green, glabrous or pubescent with uniseriate golden trichomes ca. 0.5 mm long along the midrib and primary veins abaxially, drying dark gold; major leaves 15–28 cm long, 5–8 cm wide, with 8–10 pairs of primary veins, these obscure abaxially, the apex acute, the base attenuate, somewhat winged onto the petiole; petioles 1–1.5 cm long; minor leaves differing from the majors only in size, 3–10 cm long, 1.5–5 cm wide, the apex acute, the base attenuate, somewhat winged onto the petiole; petiole 0.7–1 cm long. *Inflorescence* opposite the leaves, simple, 1–

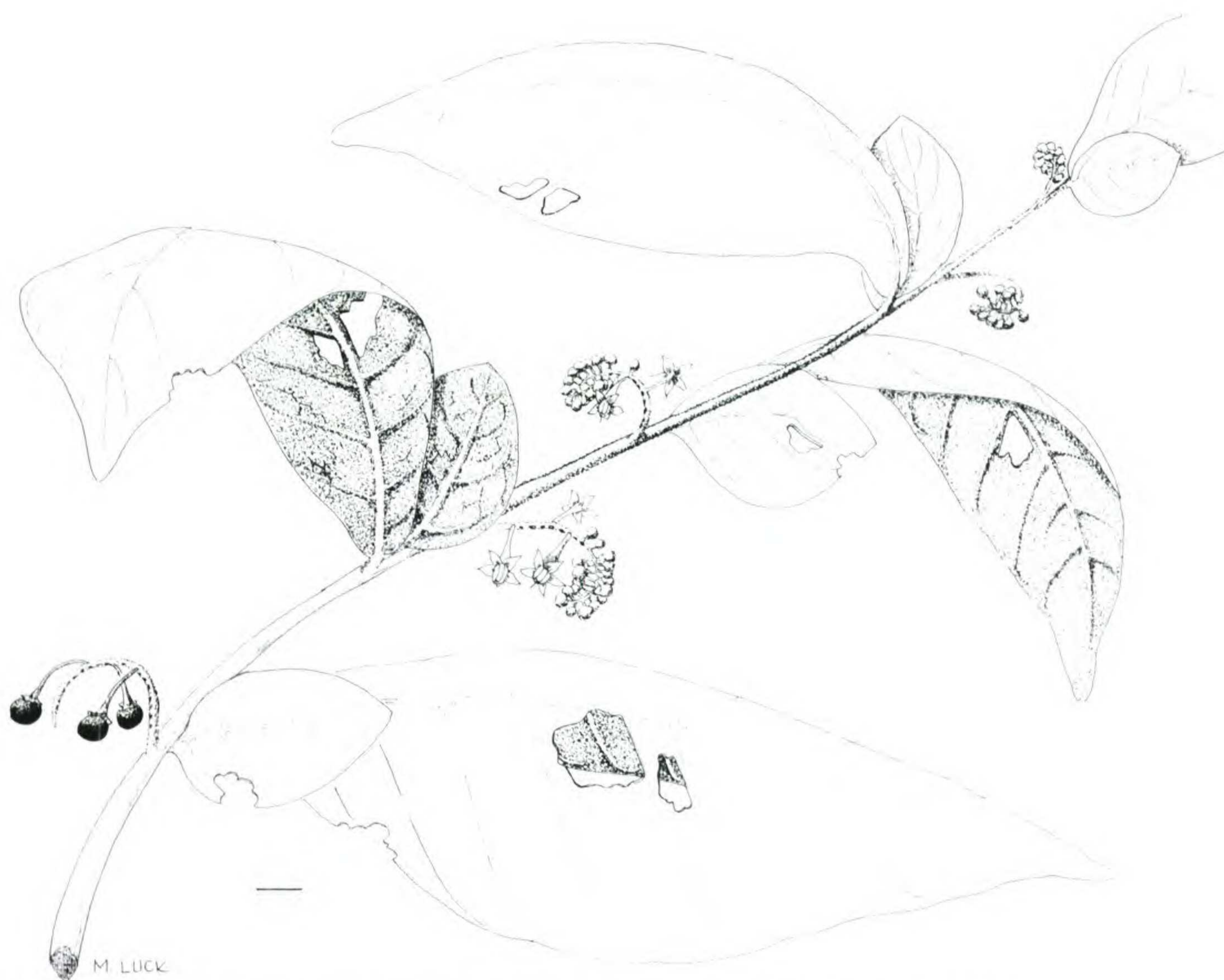


Figure 3. *Solanum malletii* S. Knapp (from Knapp & Mallet 6564, US). Scale bar = 1 cm.

3 cm long, sparsely puberulent at the tip, 20–30-flowered; pedicel scars beginning ca. halfway from the base, closely spaced, not overlapping. *Buds* elongate when very small, sparsely pubescent with uniseriate trichomes on the tips of the calyx lobes, larger buds not known. *Flowers* not known. *Fruit* a globose, green berry, 1–1.2 cm diam.; fruiting pedicels woody, deflexed, 2–2.2 cm long, ca. 2 mm diam. at the base. *Seeds* pale tan, ovoid-reniform, 3–4 mm long, 2.5–3 mm wide, the surfaces minutely pitted.

Distribution. In rainforest in northern Peru, Cajamarca and San Martín departments, from 2,000 to 2,500 m. Figure 5.

Paratypes. PERU, CAJAMARCA: Jaen, Río Agua Blanca near Río Jeronga, 8,000 ft., 30 July 1943, *Evinger 461* (US).

Solanum goniocaulon is a species of uncertain relationships in section *Geminata*. It is probably related to species in the *S. arboreum* species group (Knapp, 1986), a complex of glabrous species with usually erect fruiting pedicels and small white flowers. The flowers of *S. goniocaulon* are not known,

but the buds (on *Evinger 461*) are similar to those of *S. anisophyllum* van Heurck & Muell.-Arg., a primary forest species of the eastern Andean slope in Peru and Ecuador. The strongly 4-winged stem and the distinctive yellow color of the undersides of dried leaves readily differentiate *S. goniocaulon* from any other species of section *Geminata*.

This species is named for its distinctly angled stems (gonio—angled; caulon—stem).

Solanum malletii S. Knapp, sp. nov. TYPE: Peru, Amazonas: Bagua, Quebrada Chinganza, 8 km N of Muyo, km 472 of Oleoducto Norperuano, 350–400 m, 5°25'S, 78°28'W, 5 July 1984, *Knapp & Mallet 6564* (holotype, USM; isotypes, BH, F, K, US). Figures 3, 4.

Frutex; caules dense pubescentes; sympodia difoliata geminata anisophylla; folia supra glabra nitida subtus dense dendritico-pubescentia; folia majora obovata minora orbiculata; inflorescentiae foliis oppositae elongatae dense pubescentes; corolla viridis lobis subtus dense pubescentia; bacca globosa pubescentia; semina complanata reniformia margine incrassata.



Figure 4. *Solanum malletii* S. Knapp (Knapp & Mallet 6564, Quebrada Chinganza, Depto. Amazonas, Peru).

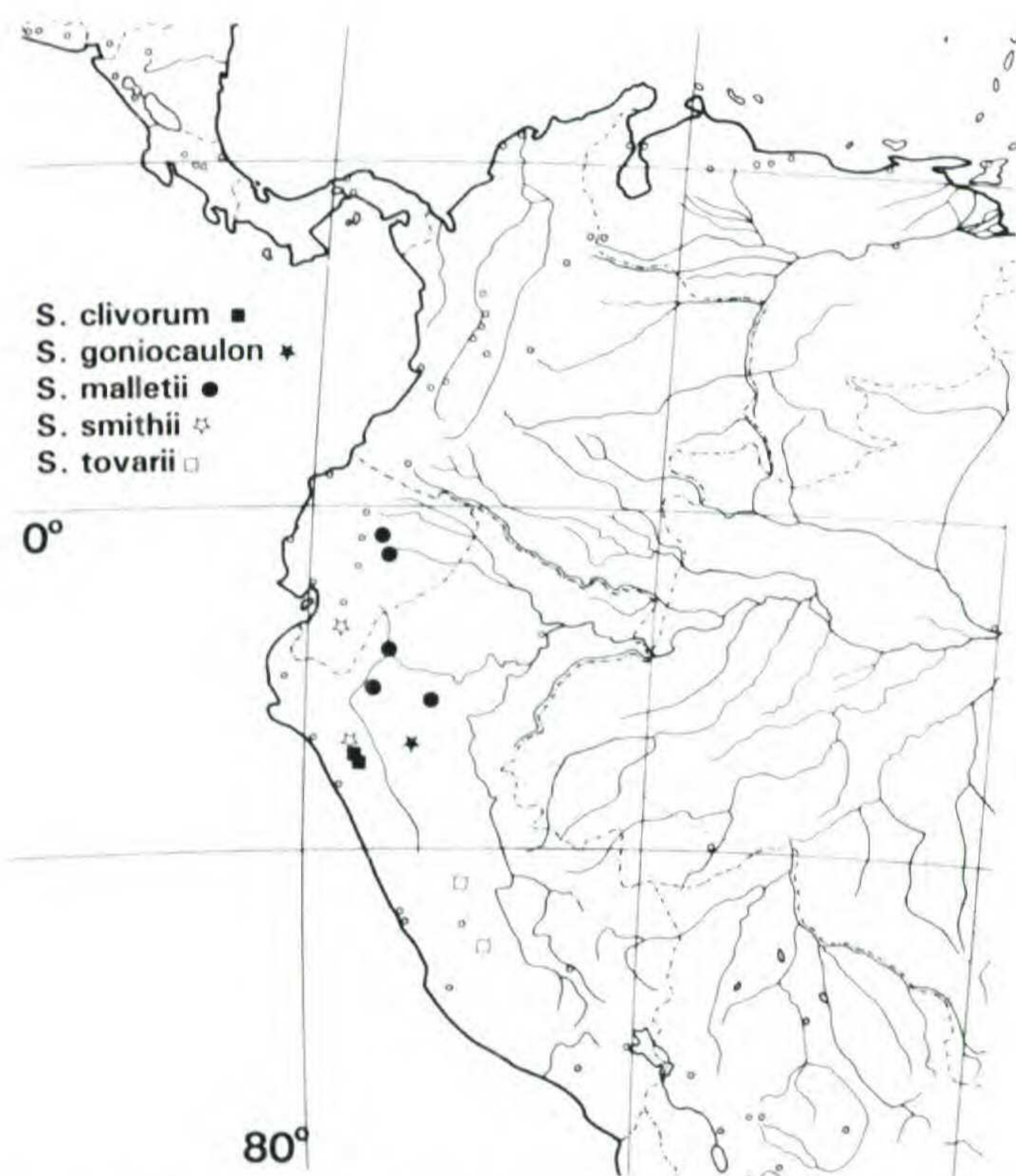


Figure 5. Distribution of *S. clivorum*, *S. goniocaulon*, *S. malletii*, *S. smithii*, and *S. tovarii*.

Slender shrubs to small trees, 1–7 m tall; young stems and leaves densely pubescent with dendritic trichomes, these 0.5–1 mm long, pale golden when dry, beige when fresh; bark of older stems reddish brown, sparsely pubescent with dendritic trichomes. *Sympodial units* difoliate, geminate, anisophyllous. *Leaves* glabrous and shining adaxially, with a few dendritic trichomes along the main veins, pubescent with dendritic trichomes abaxially, the pubescence denser along the veins; major leaves elliptic-obovate to obovate, 17–26 cm long, 8–15 cm wide, with 9–13 pairs of primary veins, the apex acute to acuminate, the base sessile and truncate, usually somewhat auriculate; petiole if present ca. 2 mm long; minor leaves differing from the majors in both size and shape, orbicular, 3–7.5 cm long, 3–7 cm wide, the apex rounded, the base rounded; petioles 1–2 mm long. *Inflorescences* opposite the leaves, simple, 1–15 cm long, 10–15-flowered, but with up to 100 scars, densely pubescent with dendritic trichomes; pedicel scars densely spaced, not overlapping. *Buds* globose, the corolla strongly exerted from the calyx tube, densely pubescent with dendritic trichomes. *Pedicels at anthesis* somewhat deflexed, strongly contracted beneath the calyx tube, ca. 1 mm diam. at the apex, 0.5 mm diam. at the base, 0.7–1 cm long, densely pubescent with dendritic trichomes like those of the rest of the inflorescence. *Flowers* with the calyx tube broadly conical, 1.5–3 mm long, the lobes triangular, 1.5–3 mm long, densely pubescent with dendritic tri-

chomes; corolla pale green, 1–1.2 cm diam., lobed ca. $\frac{3}{4}$ of the way to the base, the lobes planar at anthesis, the abaxial surface of the lobes densely dendritic pubescent; anthers 2–2.5 mm long, 1.5–2 mm wide, in the type with a few dendritic trichomes on the abaxial surface, poricidal at the tips, the pores opening to slits with age; free portion of the filaments ca. 0.25 mm long, the filament tube ca. 0.5 mm long; ovary densely pubescent with dendritic trichomes ca. 0.5 mm long; styles heteromorphic, in short-styled flowers 1–1.5 mm long, in long-styled flowers 5–6 mm long; stigma clavate, the surface minutely papillose. *Fruit* a globose, green berry, 1–1.2 cm diam.; fruiting pedicels woody, erect or deflexed, 0.7–1 cm long, ca. 1.5 mm diam. at the base. *Seeds* reddish brown, flattened-reniform with the margins incrassate and paler, 1–3 mm long, 1.5–2.5 mm wide, the surfaces minutely pitted.

Distribution. On the western margin of the Amazon basin in Ecuador and Peru, in tropical wet forest, from 200 to 500 m. Figure 5.

Paratypes. ECUADOR. NAPO: Reserva Biológica Jatun Sacha, Río Napo, 8 km E of Misahualli, 450 m, 1°04'S, 77°36'W, 21–25 May 1987, *Cerón M. 1394* (MO, NY); Parque Nacional Yasuni, Pozo Amo 2, trochas de Amosur, 230 m, 0°52'S, 76°05'W, 9–13 Jan. 1988, *Cerón M. & Coello 3182, 3298* (MO, NY). PERU. AMAZONAS: 400 m behind La Poza, Río Santiago, 180 m, 22 Aug. 1979, *Huashikat 130* (MO). LORETO: Balsapuerto, lower Río Huallaga, 150–350 m, 28–30 Aug. 1929, *Killip & Smith 28636* (NY, US).

Solanum malletii is related to *Solanum xanthophaeum* Bitter of Peru and *Solanum microleprodes* Bitter of Central and northern South America, but differs from both those species in its almost auriculate leaf bases and pubescent fruits. *Solanum xanthophaeum* shares with *S. malletii* loose dendritic trichomes, while *S. microleprodes* has congested, echinoid trichomes (see Roe, 1971; Knapp, 1989). *Solanum malletii* is found in primary rainforest as well as secondary forest. The species appears to be andromonoecious, as many flowers in the type specimen were found to be short-styled (see Fig. 4). This breeding system is probably common in section *Geminata*, but no species have yet been tested experimentally.

This species is named in honor of James Mallet, who found the type specimen and who for many years has been a patient companion.

Solanum smithii S. Knapp, sp. nov. TYPE: Ecuador. Loja: ca. 30 km S of Catamayo on road to Cariamanga, 1,900–2,000 m, 4°10'S, 79°20'W, 6 Feb. 1984, *Knapp & Mallet 6252*



Figure 6. *Solanum smithii* S. Knapp (from Knapp & Mallet 6252, NY). Scale bar = 1 cm.

(holotype, NY; isotypes, AD, BH, F, G, GH, K, MEXU, MO, QCA, QCNE, US). Figure 6.

Frutex; caules glabrae; sympodia difoliata vel plurifoliata; folia elliptica coriacea supra glabra nitida subtus pubescentia trichomatibus dendriticis in axillis venarum ferentia; corolla ignota; bacca globosa alboviridis in pedicello deflexo inserta; semina ochracea ovoidea reniformia; testa foveolata.

Shrubs to 1 m; young stems and leaves glabrous to densely red papillose, the branches erect; bark of older stems dark reddish brown. *Sympodial units* difoliolate or plurifoliolate, not geminate, with many short shoots. *Leaves* elliptic, widest at the middle,

occasionally thick and somewhat coriaceous, glabrous adaxially, pubescent with tufts of dendritic trichomes ca. 0.5 mm long in the axils of the primary veins abaxially, with 4–6 pairs of primary veins, the blades 5–14 cm long, 1.5–5.5 cm wide, the apex acute to rounded, the base attenuate, minutely winged onto the petiole; petiole 0.5–1.5 cm long. *Inflorescences* internodal or on short shoots, simple, glabrous, 1–4 cm long, 6–7-flowered; pedicel scars unevenly spaced 3–5 mm apart. *Buds* elongate and somewhat pointed, only very small buds known. *Pedicels at anthesis* not known. *Flowers* not known. *Fruit* a globose, green to greenish white berry, 1–

1.2 cm diam.; fruiting pedicels somewhat deflexed, woody, 1–1.3 cm long, 1–1.5 mm diam. at the base, 3–4 mm diam. at the apex, the calyx lobes reflexed in fruit. *Seeds* pale tan, ovoid reniform, 4–5 mm long, 3–4 mm wide, the surfaces minutely pitted.

Distribution. In dry forests and scrublands in the Huancabamba depression of northern Peru and southern Ecuador, from 1,900 to 2,600 m. Figure 5.

Paratype. PERU. CAJAMARCA: Condebamba valley, Cajabamba–Cajamarca road, 2,100–2,600 m, 7°33'S, 78°09'W, 15 Feb. 1983, *Smith & Vasquez 3409* (MO, NY, USM).

Solanum smithii is similar to *S. barbulatum* Zahlbr., also of highland Ecuador and Peru, but differs from that species in its ovoid reniform seeds and axillary tufts of dendritic trichomes. The closest relative of *S. smithii* is *S. tunariense* Kuntze of Andean Bolivia. *Solanum smithii* differs from *S. tunariense* in having trichomes confined to small tufts in the axils of the primary veins on the abaxial leaf surfaces, its somewhat larger leaves, and its longer fruiting pedicels. The flowers of *S. smithii* are not known, but from the shape of the immature buds I expect them to have elongate calyx lobes.

The leaves on the type specimen are much larger than and not as coriaceous as those on *Smith & Vasquez 3409*. The type was collected in a shady, wet quebrada, while the Peruvian collection is probably from a more open habitat.

This species is named in honor of the late D. N. Smith, an indefatigable collector of Peruvian plants and the collector of the paratype.

Solanum tovarii S. Knapp, sp. nov. TYPE: Peru. Huancavelica: Hacienda Tocas entre Colcabamba y Paucarbamba, 3,000–3,100 m, 19 Apr. 1954, *Tovar 1932* (holotype, USM; isotype, IBE). Figure 7.

Frutex; caules dense pubescentes trichomatibus simplicibus uniseriatis; sympodia difoliata geminata; folia elliptica coriacea supra sparse subtus dense pubescentia margine revoluta; inflorescentiae foliis oppositae simplices sensu pubescentes; calycis lobi quadratus; corolla alba carnosa; bacca matura et semina ignotae.

Shrubs 1–2 m tall; young stems and leaves densely pubescent with soft, uniseriate, simple (occasionally branched) trichomes 1–2 mm long; bark of older stems greenish brown, glabrate. *Sympodial units* difoliolate, geminate. *Leaves* elliptic, thick and somewhat leathery with revolute margins, sparsely pubescent with uniseriate trichomes like those of the

young growth adaxially, the trichomes denser along the main veins, the adaxial epidermis large-celled and crystalline, more densely pubescent with uniseriate, simple or branched trichomes abaxially; major leaves 4–8.5 cm long, 1.5–3.5 cm wide, with 7–10 pairs of primary veins, these drying yellowish, the apex acute, the base acute; petiole 0.3–1 cm long; minor leaves differing from the majors only in size, 1.5–4.5 cm long, 0.5–2.1 cm wide, the apex acute, the base acute; petiole 2–5 mm long. *Inflorescences* opposite the leaves, simple, 2–4 mm long, densely pubescent with uniseriate trichomes like those of the stems and leaves, 3–5-flowered; pedicel scars densely packed, overlapping. *Buds* globose, the corolla exerted from the calyx tube. *Pedicels at anthesis* tapering, 0.7–1 cm long, deflexed, sparsely pubescent with uniseriate, simple trichomes like those of the inflorescence, ca. 0.5 mm diam. at the base, 1 mm diam. at the apex. *Flowers* with the calyx tube broadly conical, 1.5–2.5 mm long, the lobes quadrate with minute apiculae, sparsely pubescent with simple, uniseriate trichomes, the apiculae with tufts of simple trichomes; corolla white, waxy, 1.3–1.5 cm diam., lobed $\frac{3}{4}$ of the way to the base, the lobes planar at anthesis, the tips and margins of the lobes densely papillose; anthers 4–4.5 mm long, 1.5–2 mm wide, poricidal at the tips, the pores becoming slitlike with age; free portion of the filaments ca. 0.25 mm long, the filament tube minute, often not present, glabrous; ovary sparsely pubescent with simple, uniseriate trichomes ca. 0.5 mm long; style ca. 6 mm long, pubescent at the base; stigma capitate, the surface minutely papillose. *Fruit* a globose, green berry (immature), sparsely pubescent; fruiting pedicels woody, erect, ca. 1.5 cm long. *Seeds* not known.

Distribution. In high-elevation savanna areas in the Peruvian departments of Huancavelica and Junín, from 2,700 to 3,300 m. Figure 5.

Paratypes. PERU. HUANCVELICA: Tayacaja, Salcabamba, 3,250 m, 7 Jan. 1939, *Stork & Horton 10273* (F, K). JUNIN: Carpapata above Huacapistana, 2,700–3,200 m, 7 June 1929, *Killip & Smith 30680* (NY, US).

Solanum tovarii is superficially similar to *S. maturecalvans* Bitter (an earlier name for *S. aureifolium* Rusby), but lacks the arachnoid trichomes of that species. The trichomes of *S. tovarii* are exclusively uniseriate and can be simple or dendritic. *Solanum tovarii* is probably most closely related to *S. barbulatum* Zahlbr. of Andean Colombia to northern Peru and differs from that species in its quadrate calyx lobes, larger flowers, and in its evenly distributed abaxial leaf pubescence. In *S. tovarii* trichomes are found over the entire lower leaf surface, while



Figure 7. *Solanum tovarii* S. Knapp (from Tovar 1932, IBE). Scale bar = 1 cm.

in *S. barbulatorum* they are generally confined to the axils of the main veins.

This species is named in honor of Oscar Tovar, Peruvian graminologist, collector of the type specimen, and a great help to botanists visiting Peru.

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of F, HUT, IBE, MO, NY, US, USM for the loan of specimens.

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